ABSTRACT

QUEEN, TARA L. Aging and Affective Forecasting: An Examination of the Impact of Goal Orientation. (Under the direction of Thomas M. Hess, PhD).

Much of the previous research on affective forecasting has focused on understanding the biases in individuals' predictions of future emotional states rather than investigating how forecasts are developed. These studies have also traditionally concentrated on explaining the phenomenon in a younger age group. The purpose of the current study was to examine age differences in affective forecasts by considering the role of goal orientation. If aging is associated with decreases in promotion focused orientation and increases in prevention focused orientation, these shifts may influence older adults' predicted reactions to the experience of gains and losses. In order to examine this idea, young and older adults (N = 127) engaged in a computer-based gambling game in which they were asked to predict how they would feel in response to winning or losing a bet and the game as a whole. The task payoff structure was manipulated to mirror strategies that were predicted to be consistent with a promotion or prevention orientation. Participants provided affective ratings after each of the 20 task trials and at the conclusion of the game. The findings of the study suggest that young and older adults display different patterns of predicted responses to gains and losses. Overall, older adults were more accurate in their forecasted affect in losing the game than young adults, suggesting increased insight into affective process in older adulthood. Additionally, goal orientation did influence participants' thoughts prior to making their affective forecasts. Young adults were more likely to report winning-related thoughts first, whereas older adults were more likely to report losing-related thoughts first. The content of thoughts (i.e., winning or losing-related) was related to goal orientation, with a stronger

promotion-orientation being associated with the production of winning-related thoughts. Fluctuations in affective responses and the discrepancy between predicted and experienced affect over time were also examined.

Aging and Affective Forecasting: An Examination of the Impact of Goal Orientation

by
Tara L. Queen

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APPROVED BY:

Thomas Hess
Committee Chair

Jason Allaire

Daniel Grühn

Shevaun Neupert

BIOGRAPHY

Tara L. Queen graduated from Meredith College in Raleigh, NC with B.S. degrees in Psychology and Spanish. Following the completion of her undergraduate studies, she enrolled in a combined M.S. and Ph.D. program in Lifespan Developmental Psychology at North Carolina State University under the direction of Thomas M. Hess, Ph.D. Tara held a research assistantship in the Adult Development Laboratory throughout her graduate career. Her graduate research focused on social cognition in older adulthood. Tara earned her M.S. in Psychology in December 2008. Her Master's thesis research investigated differences in young and older adults' decision making processes. Following the completion of her Ph.D. Tara will begin a postdoctoral fellowship with the Institute for Social Research at the University of Michigan.

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Introduction

A brief review of recent research reveals a complex relationship between aging and decision making. While some research reports decrements in decision-making ability (e.g. Finucane et al, 2005), other studies describe older adults as adaptive decision makers (e.g. Mata, Schooler, & Rieskamp, 2007; Wood et al, 2005). In thinking about the influence of age, it is important to consider the multidimensional nature of judgment and decision making processes (e.g., Bruine de Bruin et al, 2007) in conjunction with the changing constellation of abilities and knowledge during adulthood. For example, the dual- process model suggests that information processing may occur through effortful deliberation or reliance on intuition or affective judgments (Epstein, 1994). Age-related cognitive declines may negatively impact deliberative processing, but increased knowledge and experience and shifts in emotional goals may result in more efficient affective or experiential processing of decision information (Peters, Hess, Västfjäll, & Auman, 2007). Few studies have investigated how young and older adults use affective information to guide their judgments; thus, the aim of the current study was to examine differences in ability to predict future affective states.

Affective Forecasting

One way in which individuals incorporate affect into their judgments is by relying on affective forecasts, or predictions of how one will feel in the future. Presumably, choosing an option that has been predicted to have great hedonic benefits should lead to increased happiness in the end. Research on affective forecasting, however, has consistently demonstrated that individuals are often inaccurate in their forecasts. Although forecasters are able to predict the valence of their future state, they often overestimate the intensity and duration of their predicted emotional response (for review see Wilson & Gilbert, 2005). For example, one study found that teenagers who were about to take their driving test overestimated the duration and intensity of their negative mood after failing the test (Finkenauer et al, 2007). This type of overestimation of an emotional reaction is a common inaccuracy known as the impact bias (Wilson & Gilbert, 2005). There may be several factors that cause this bias. One proposed mechanism is focalism, or the tendency to view emotional reactions in isolation by neglecting to consider how other unrelated life events may influence predicted thoughts and feelings. When asked to consider activities outside of the forecasted event, individuals produce more accurate forecasts, and impact bias is reduced (Wilson et al, 2000). Researchers have also suggested immune neglect, or the inability to understand how one may psychologically cope with or recover from an event, as another explanation for the impact bias when evaluating negative outcomes (Gilbert et al, 1998). Forecasters seem to be unaware of their ability to apply coping mechanisms and emotion regulation strategies. Given the relatively automatic nature of these processes, it is understandable that they are not taken into account when predicting future emotional states, resulting in individuals neglecting to consider how their emotions will change over time.

Much of the research on affective forecasting has been conducted with young adults, with little consideration of developmental factors. It is possible that the process of constructing forecasts changes with age, in that shifts in chronic goals may result in qualitative differences in young versus older adults' affective forecasts. These age differences may in turn reduce errors that underlie the impact bias. For example, given their experience in making important decisions throughout their adult lives, it is possible that older adults are more likely to embed their affective forecasts into the context of daily life rather than viewing their predicted emotional states in isolation of such events. Thus, focalism effects may decrease with increasing age, at least for decisions that may have some level of familiarity. Previous research supports the idea that experience leads to improved emotion regulation and problem solving strategies. For example, researchers have found that older adults are more effective and flexible in solving interpersonal problems (Blanchard-Fields, Mienaltoski, & Seay, 2007), which may be related to experience and superior emotion regulation (for review, see Blanchard-Fields, 2007; Scheibe & Carstensen, 2010).

Regulatory Focus and the Integration of Query Theory

The aim of this study was to understand if age differences in goal orientation also influence affective forecasting. Regulatory focus theory posits two self-regulation orientations. A promotion focus emphasizes achievement and motivation to approach gains and avoid non-gains, whereas a prevention focus emphasizes safety and motivation to approach non-losses and avoid losses (Higgins, 1997). Regulatory focus theory also proposes two different means of goal-attainment. Eagerness means (approach) focuses on obtaining hits and avoiding misses whereas vigilance means (avoidance) focuses on ensuring correct rejections and avoiding false alarms (Higgins, 2002). Goals may be attained using either focus, but regulatory fit occurs when the means of goal attainment fits with the individual's regulatory focus. That is, regulatory focus theory predicts a natural fit between a promotion focus orientation and eagerness means and between a prevention focus orientation and vigilance means. In a theoretical manuscript on the role of regulatory focus in decision making, Higgins (2002) posited that regulatory fit may moderate individuals' prospective emotions about a decision:

> For positive outcomes, the higher regulatory fit for promotion than prevention focus should be reflected in people being more motivated to make the desirable choice happen for a promotion focus gain than a prevention focus nonloss. For negative outcomes, the higher regulatory fit for prevention than promotion focus should be reflected in people being more motivated to make the undesirable choice not happen for prevention focus loss than a promotion focus nongain. (p. 184)

Thus, affective forecasts may be influenced by regulatory fit in that promotion focused individuals may overestimate their emotional reactions to a gain and prevention focused individuals may overestimate their emotional reactions to a loss. Their overestimation may be attributed to the motivation to achieve or avoid, as dictated by regulatory fit. Regulatory focus theory predicts specific emotional reactions to goal achievement and experience of loss. In a promotion focus, successful goal attainment is associated with elation whereas unsuccessful attempts are associated with dissatisfaction. In a prevention focus, goal attainment is associated with contentment whereas unsuccessful attempts are associated with agitation (Leone, Perugini, Bagozzi, 2005). It is possible that increased arousal associated with gains in those with a promotion focus and loss in those with a prevention focus is related to greater affective forecasting errors.

Although regulatory focus theory itself does not make predictions regarding shifts due to age, there is some evidence suggesting such. In a study examining the effectiveness of positive and negative health role models, Lockwood, Chasteen, and Wong (2005) found that age differences in regulatory focus resulted in differing role model preferences. Young adults reported having a stronger promotion focus than older adults which was related to being more motivated by positive health role models, whereas older adults reported increased motivation from negative health role models. One possible basis for the prediction of an age-related shift in goal orientation may be drawn from the gain-loss dynamic proposed by life-span developmental theory (Baltes, 1987). This concept explains that both gains and losses in functioning are present throughout the lifespan, but that the ratio of losses to gains gradually increases in older adulthood (Baltes, Staudinger, & Lindenberger, 1999). With this shift, it is predicted that older adults' focus becomes maintaining functioning and preventing further losses whereas young adults emphasize maximizing growth and achieving gains in performance. An emphasis on growth-based goals reflects the cognitive capacity available in young adulthood and may allow young individuals more resources to dedicate to recovering from losses. As resources decrease with age, older adults may instead dedicate these resources to maintaining current ability and preventing future losses. In terms of regulatory focus theory, growth-based optimization associated with young adulthood may be compared to a promotion focus orientation. Similarly, loss-based compensation associated with aging may be compared to a prevention focus orientation, given the emphasis on avoiding losses.

Following Higgins' (2002) predictions, differential responses to gains and losses due to age-related shifts in regulatory focus may influence the construction of affective forecasts. Age differences in goal orientation may predict different reactions to gain or loss outcomes, which could then influence forecasting accuracy. For example, an individual who is focused on achieving gains may predict higher arousal responses to positive outcomes (i.e. wins) whereas an individual focused on preventing losses may predict higher arousal responses to negative outcomes (i.e. losses). If the goal of a promotion orientation is to achieve gains, than the predicted affective response may be stronger when a gain is experienced. Conversely, if the goal of a prevention orientation is to avoid losses, than the predicted affective response to experiencing a loss may be quite intense.

One way in which goal orientation may be involved in the construction of affective forecasts is through the use of salient information that is activated in memory. Weber and Johnson (2009) have proposed that individuals construct preferences by consulting their memory and drawing from previous experiences. In several experiments testing this idea, known as query theory, researchers have found that participants' goals elicited different queries or influenced the order in which queries were formed. For example, in a study examining the mechanisms behind the endowment effect, participants who posed as "buyers" produced more value-decreasing thoughts or queries about the target product whereas those posed as "sellers" produced more value-increasing queries (Johnson, Häubl, & Keinan, 2007). The buyers' and sellers' queries were related to the price they were willing to pay or accept for the product, with buyers demanding a lower price and sellers demanding a higher price. When participants' queries were guided by the experimenter so that buyers were asked to consider the valuable aspects of the product first and sellers to consider the less desirable aspects first, the price differences were minimized. The participants' goals as buyers or sellers primed their memory queries and inhibited their responses from the opposite goal (Weber & Johnson, 2009). Similar effects were found in a study examining asymmetric temporal discounting, in that participants who were asked if they would like to delay consumption generated more patient thoughts first whereas those who were asked if they would like to accelerate consumption generated more impatient thoughts (Weber et al, 2007).

When the order of queries was reversed, the asymmetry in discounting was attenuated. The results of these two studies suggest that there is a natural order in the elicitation of queries that is driven by the decision makers' goals, and that a decision can be manipulated by reversing the order of these queries. Although query theory does not necessarily address the process of forming affective forecasts, it suggests that goals and memory of past experiences play a vital role in making decisions.

Previous research on affective forecasting has focused on identifying inaccuracies rather than the process in which forecasts are constructed. The current study investigated the possibility that goal orientation guides the development of affective forecasts. Following query theory, in making predictions about future emotional states, an individual focused on gains and optimization of performance may consider different information or recall different experiences than one who is focused on minimizing losses. That is, promotion focused individuals may first consider the impact of achievement whereas prevention focused individuals may concentrate on the costs of experiencing a loss. This order and weighting of queries may be evidenced in young and older adults if there are age differences in regulatory goals.

Age differences in affective forecasts may also be observed when the "fit" between chronic regulatory goals and the strategy for optimal performance on the task vary. One possibility is that forecasting errors will be stronger when age-relevant goals are activated. For example, when the task is best performed by engaging in a promotion focus strategy, young adults may overestimate the intensity of their emotional responses to wins due to motivation to achieve gains. Older adults, in comparison, may overestimate their responses to losses when a prevention focus strategy is needed, given their motivation to prevent the experience of a loss. Congruency between chronic, age-related regulatory focus and explicit task demands was expected to result in predictions of stronger emotional responses to achievement or failure.

Aging and Affective Forecasting

Currently, only one published study has investigated age differences in affective forecasts. Nielsen, Knutson, and Carstensen (2006) examined the accuracy of young and older adults' affective forecasts during a game involving large and small monetary gains or losses. Participants were asked to estimate their emotional valence and arousal before and after experiencing a gain or loss. Similar to previous forecasting studies, both young and older adults were accurate in predicting the valence of their future emotional state (i.e. either positive or negative mood); however, young adults were less accurate than older adults in predicting their future arousal. Specifically, young adults underestimated their arousal during the anticipation stage of the task and overestimated their arousal in actually receiving gains. Although both age groups experienced increased arousal when anticipating loss as opposed to experiencing loss, only older adults were more accurate in their forecasts of these changes. A closer examination of the loss domain revealed that older adults were more accurate in their forecasts that loss anticipation, as opposed to experience of loss, would not affect their overall emotional valence. Based on these findings, the researchers concluded that older adults have insight into their feelings of loss and that young and older adults process information regarding gains and losses differently. Although this is a plausible explanation, given that participants were only asked to provide ratings of their emotional states, age differences in how young and older adults processed the information could not be examined.

In the current study, I predicted that goal orientation would influence the accuracy and qualitative nature of affective forecasts. If older adults tend to be more prevention-oriented than young adults, their affective forecasts may be based on the motivation to avoid incurring losses. Young adults' forecasts, on the other hand, may be motivated by an orientation towards achieving gains. More specifically, the congruency between an individual's goal orientation and the provided strategy for accomplishing the task was expected to influence forecasting accuracy. Higgins (2002) posited that regulatory fit encourages individuals to achieve their goals, possibly resulting in the prediction of an exaggerated emotional response. This suggestion leads to the hypothesis that an overestimation of future emotional states may occur when task goals match young and older adults' chronic regulatory focus. That is, when young adults are asked to complete the task requiring a promotion focus strategy and when older adults are asked to complete the task requiring a prevention focus strategy, their predictions of their future states were expected to be exaggerated. This is expected to be particularly true for outcomes related to high-arousal emotions associated with the relevant regulatory focus (i.e., positive outcomes for younger adults, negative outcomes for older adults). When there is a mismatch between participants' chronic goals and the task structure, affective forecasting accuracy may actually be improved due to the absence of high arousal emotions.

Additionally, it is predicted that an orientation towards growth (or promotion focus) versus maintenance (or prevention focus) would elicit queries consistent with those goals.

That is, individuals in a promotion focus were expected to provide queries related to achievement of gains first. Those in a prevention focus were expected to provide queries related to avoidance of losses first.

Current Study

In the present study, young and older adults engaged in a computer-based gambling game. The game required participants to make a bet on each trial and the goal of the game was to achieve as much money as possible. Two versions of the game were constructed by manipulating need for risk taking: one which reinforced a promotion focus and the other which reinforced a prevention focus. It was predicted that individuals would provide less accurate affective forecasts when age-congruent goals were activated. If older adults are indeed more motivated to avoid incurring losses, they may be more apt to select a safer strategy that will lead to fewer losses over time. This strategy will be reinforced when the task structure rewards less risk taking and may result in less accurate forecasts when experiencing a loss. A promotion orientation may lead young adults to focus their forecasts on the experience of achieving gains. In contrast to older adults, they may be more likely to select a riskier strategy in order to obtain more gains over time. A task structure which rewards risk taking would be more congruent with young adults' goal orientation; thus, participants in this age group may report less accurate forecasts when experiencing a gain in this condition.

The task was designed so that trial-by-trial change in affective state could be examined. Change in emotional state over time under match or mismatch conditions between chronic focus and task demands was of particular interest. Participants gambling approach should be reinforced when there is match between goal orientation and task structure. Under these conditions, participants' emotional state is expected to remain relatively stable over the trials. When there is a mismatch between task structure and participants' goal orientation, their selected strategies will be disadvantageous. Under this mismatch condition, it is expected that emotional intensity will increase over time due to frustration and lack of reinforcement.

Method

Design

A 2 (Age Group) X 2 (Task structure [low risk vs. risky]) between-subjects design was used in which half of the participants in each age group were randomly assigned to the task structure condition.

Participants

Sixty four young (22-40) and 63 older (70-91) adults were selected from a laboratory database of community-dwelling adults. Participants were screened for potential cognitive impairments using the Short Blessed (Katzman et al., 1983), though all participants scored within normal limits (i.e., 8 or below). Several participants failed to answer the final happiness question (N = 10) and were thus eliminated from the affective forecasting accuracy analyses. These eliminated participants were equally dispersed across age groups (i.e., 5 young and 5 older adults). One participant only completed 15 out of 20 trials and was eliminated from all but the forecasting analyses. Three participants completed 19 of the trials, but were included in all analyses. Additionally, one participant's gambling task data was lost due to a technical error, but remained in the sample for analyses related to query theory and regulatory focus. Participants were awarded a $25 honorarium for completing the study, but were also given the opportunity to acquire up to an additional $10 based on their performance on the gambling task.

Participant characteristics. As can be seen in Table 1, there were no age differences in years of education or performance on the WAIS vocabulary test. Normative age differences were found in the letter number series and digit-symbol substitution tasks, with older adults performing more poorly. Similarly, older adults scored lower than young adults on the numeracy questionnaire.

Young and older adults had similar interest in and experience with gambling (*ps* > .05).

Table 1

Participant Characteristics

	Young	Old
Age (in years)	31.29 (5.11)	76.17 (4.84)
Education (in years)	16.37 (1.96)	16.57 (2.69)
Vocabulary	47.05 (8.49)	48.23 (8.11)
Letter-Number Sequencing	12.70 (3.38)	9.54 (1.95)
Digit-Symbol Substitution	86.52 (14.90)	57.68 (10.86)
Numeracy	8.73 (2.12)	7.76 (2.21)
Gambling interest	4.87 (2.66)	4.05 (2.83)
Gambling experience	4.94 (2.47)	4.24 (2.66)

Note. Vocabulary (range, 0-66), Letter-Number Sequencing (range, 1-21), Digit-Symbol Substitution (range, 1-133), and Numeracy (range, 0-11).

Materials

A simple computer-based gambling game was designed for this study. A number line anchored at zero and 100 was shown on the computer screen along with a number above 55 or below 45 plotted on the line (see Figure 1). A pilot study determined that this range of values allowed for variability in making risky and safe bets. The goal of the task was to wager whether the next number to appear would be greater or less than the first number. For example, if the number 65 was shown on the screen, participants were asked to bet whether the next number would be above or below 65. Reliance on a basic understanding of probabilities may lead an individual to wager that the next number would greater if the first number were below 45. Similarly, if the first number were above 55, a probability based method would predict that the next number would be less. Following the appearance of the number, participants decided between a more risky (i.e., lower probability) or less risky (i.e., higher probability) bet. The amount of the wager corresponded to the probability of the bet, with lower probability bets requiring a $1.00 wager and higher probability bets requiring a $0.50 wager.

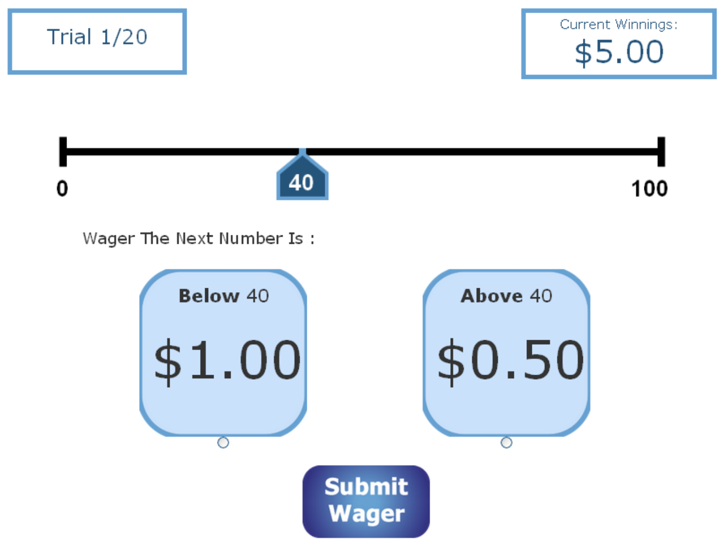


Figure 1. An example trial in the gambling task. A number was presented on the number line and participants were asked to wager whether the next number to appear would be above or below the number on the line.

Two versions of the gambling task were designed. In one condition, the outcomes of the gambling task were generally consistent with what would be expected by chance. On 80% of the trials, the number "generated" by the computer was in the larger range of possible values. In this condition, adherence to a strategy of always selecting the more probable outcome (i.e., low risk) was rewarded with a smaller gain ($0.50), but avoided losses and resulted in more wins over time. In the second condition, the task was constructed so that the risky bet (i.e., selecting the smaller range of numbers) was rewarded at a higher than chance level: 50%. Thus, engaging in a risky strategy resulted in more frequent high gains than would be predicted by chance. Choosing the risky bet resulted in a reward of $1 on 10 out of 20 trials. A graphic depicting the amount won was displayed on the computer screen and was updated after each individual trial.

Participants completed health and demographic questionnaires as well as a measure of chronic regulatory focus (Lockwood, Jordan, & Kunda, 2002; see Appendix) before arriving for the testing session. The regulatory focus questionnaire contained promotion- and prevention focus subscales, both of which were reliable ($\alpha = .92$ and $\alpha = .83$, respectively). Cognitive ability was assessed after the gambling task using three subtests from the WAIS-IV (Wechsler, 1997): Letter-Number Series, Digit Symbol Substitution, and Vocabulary.

Procedure

Before viewing the game, participants were told that on each trial, they would have the choice of making a bet on one of two options: In some cases, the bet may be high payoff but also high risk whereas in other cases, the bet may be lower payoff but safer. At the start of the session, participants were given $5.00. Participants were told that based on their performance on the task they may win up to an additional $5 (for a total of $10) or they may lose everything. The amount that they eventually ended up with was based on their performance on the task. Thus, if they won $5 in the gambling game, they kept the $5 they received at the start of the task. If the won $8 in the game, participants were given an additional $3 at the end of the task. Similarly, if they only won $3, participants lost $2 of their original $5. Participants were then given a short questionnaire which assessed interest in and experience with gambling as well as a baseline measure of mood ("How happy would you say you feel these days?", see Gilbert et al, 1998).

Before beginning the task, queries were gathered by asking participants to indicate what they were thinking and why as they consider the possible outcomes of the task (i.e., winning or losing; see Weber et al., 2007). Participants were given a sheet of paper with five numbered lines and were asked to indicate up to five thoughts regarding winning or losing the game. They were then asked to predict how happy they would feel if they won and lost the game as well as how happy they would feel after winning or losing a bet. Predictions were made on a nine-point Likert scale (-4 [very unhappy] to 4 [very happy]).

Throughout the task, participants were asked to report their emotional state on a nine-point scale (-4 [negative] to 4 [positive]) after experiencing a gain or a loss on each individual trial. After the last trial, participants' final winnings were shown on the screen and they were given their winnings in cash. They were then asked to report their current emotional state on a 9-point scale once more (-4 [very unhappy] to 4 [very happy]). Prior to statistical analyses, all scales were recoded from -4 to +4 to 1 to 9 for ease of interpretation. Upon finishing the task, participants completed the WAIS subtest and numeracy questionnaire.

Results

Chronic Regulatory Focus

Before conducting the main analyses, I examined whether the predicted age differences in regulatory focus were present in this sample. A 2 (Age Group) X 2 (Focus [promotion vs. prevention]) mixed ANOVA was conducted on the two subscales of the regulatory focus questionnaire to determine if age differences exist in chronic regulatory focus. There was a significant two-way interaction, F (1, 125) = 8.86, p = .003, η_p^2 = .07, with young adults scoring higher than older adults on the promotion focus subscale (M = 7.24, SD = 1.32 vs. M = 5.12, SD = 1.76) as well as slightly higher on the prevention focus subscale (M = 4.69, SD = 1.55 vs. M = 3.54, SD = 1.56). Post-hoc analyses of this interaction revealed significant age group differences in each of the subtests (*ps* < .001).

Following Lockwood, Chasteen, and Wong (2005), in order to assess dominant regulatory focus, participants' scores from the prevention focus subscale were subtracted from those of the promotion focus subscale. Higher scores on this univariate measure indicate a stronger promotion than prevention focus. A one-way ANOVA revealed significant age differences in this construct, F (1, 125) = 8.86, p = .003, η_p^2 = .07, with young adults (M =2.55, SD = 2.02) being more strongly promotion focused than older adults (M = 1.58, SD = 1.66). This is generally consistent with expectations regarding age differences in regulatory focus.

Game-Related Outcomes

Winnings. Prior to analysis of my primary outcome variables, I examined success at the gambling task. Participants won an average of $5.53 (SD = 4.10) in the task. A 2 (Age Group) X 2 (Task Structure) ANOVA determined that young adults won more money (M = $6.29, SD = 4.11) than older adults (M = $4.76, SD = 3.95), F (1, 123) = 4.47, p = .04, η_p^2 = .04. There was no effect of task structure, F (1, 121) = 0.46, p = .50, η_p^2 = .00, nor an interaction between age and task structure, F (1, 121) = 1.89, p = .17, η_p^2 = .02, on amount of money acquired in the game.

Nature of bets. One way to examine how participants responded to each of the task structures was to determine the riskiness of each bet. Based on a probabilistic rule assuming truly random generation of the second number, bets could be classified as safe or risky depending upon the range from which this number would have to come for the participant to win. For example, if the number 22 was presented as the target number and the participant bet the next number to appear would be below 22, the bet was classified as risky. If the participant wagered that the next number to appear would be greater than 22, the bet was categorized as safe. The proportion of risky bets was computed for the first 10 trials and the last 10 trials in order to determine if participants switched or were consistent in their risk taking preferences. A 2 (Age Group) X 2 (Task Structure [risky vs. non-risky]) X 2 (Time [trials 1-10 vs. trials 11-20]) repeated measures ANOVA was conducted. A significant Task Structure X Time interaction emerged, F (1,121) = 7.60, p= .01, η_p^2 = .06. A post hoc analysis of this interaction revealed that participants in the risky task structure exhibited a significant increase in the proportion of risky bets from the first (M= 0.28, SD = 0.03) to the second half of the task (M = 0.37, SD = 0.03). The opposite pattern occurred for those in the non-risky task structure (Ms = 0.30, SD = 0.03 vs. 0.28, SD = 0.03), although switch in bet preference was not significant. This indicates some sensitivity to the payoff structure of gambling task. There were no age differences in this sensitivity.

Affective Responses

In order to examine fluctuations in participants' trial-by-trial responses to winning and losing, a multilevel model was conducted on participants' affective responses following each bet. Because trials resulting in both wins and losses were included in the model, affective responses to loss trials were reverse-coded to create consistency in the scale and to facilitate interpretability. Thus, higher scores represented intensity of the expected responses for wins (i.e., happiness) and losses (i.e., unhappiness). Bet outcome (i.e., win or loss) was included as a Level 1 variable as was trial number, in order to test for the linear effect of time. Age group and task structure were included as Level 2 variables and baseline happiness was entered as a covariate.

A fully unconditional model established that there was sufficient Level 1 and 2 variability, with 40% of the variability in affective ratings being between people (τ_{00} = 0.84, z = 7.32, p < .001) and 60% of the variability being within people (σ^2 = 1.28, z = 34.44, p < .001).

The following model resulted in a better fit when the slopes between trial and affective response and bet outcome and affective response were constrained, $\chi 2$ (9) = 1285.4, p < .05 (Singer, 1998):

Level 1: Affective Response$_{ij}$ = β_{0ij} + β_{1ij} (Trial) + β_{2ij} (Bet Outcome) + β_{3ij} (Trial X Bet Outcome) + r_{ij}

Level 2: β_{0i} = γ_{00} + γ_{01} (Baseline Happiness) + γ_{02} (Age Group) + γ_{03} (Task Structure) + γ_{04} (Age Group X Task Structure) + u_{0i}

β_{1i} = γ_{10} + γ_{11} (Age Group) + γ_{12} (Task Structure) + γ_{13} (Age Group X Task Structure)

β_{2i} = γ_{20} + γ_{21} (Age Group) + γ_{22} (Task Structure) + γ_{23} (Age Group X Task Structure)

β_{3i} = γ_{30} + γ_{31} (Age Group) + γ_{32} (Task Structure) + γ_{33} (Age Group X Task Structure)

As can been seen in Table 2, this model revealed several significant three-way interactions, including Trial X Age Group X Task Structure (γ_{13} = 0.05, t = 2.23, p = .03), Bet Outcome X Trial X Task Structure (γ_{32} = 0.06, t = 2.66, p = .008), and Bet Outcome X

Age Group X Task Structure (γ_{23} = 0.93, t = 2.73, p = .006). Given the complexity of this model, two separate multilevel models were conducted in order to examine responses between age groups and tease apart the obtained interactions. In addition to improving interpretability, these models also allowed the examination of specific hypotheses regarding differential affect responses for young and older adults.

Table 2
Estimates for Multilevel Models Examining Affective Responses

Fixed effects	
Intercept	6.12 (.22)**
Trial	0.02 (.01)
Bet outcome	1.18 (.18)**
Age group	0.31 (.31)
Task structure	0.61 (.29)*
Task structure x age group	-0.88 (.41)*
Trial x bet outcome	-0.03 (.02)
Trial x age group	0.001 (.02)
Trial x task structure	-0.05 (.02)*
Bet outcome x age group	-0.29 (.25)
Bet outcome x task structure	-0.86 (.24)**
Trial x bet outcome x age group	0.001 (.02)
Trial x age group x task structure	0.05 (.02)*
Bet outcome x trial x task structure	0.06 (.02)*
Bet outcome x age group x task structure	0.93 (.34)**
Trial x bet outcome x age group x task structure	-0.04 (.03)
Random effects	
Intercept	0.84 (.12)**
Residual	1.13 (.03)**

Note: *p < .05; ** p <.01

Young adults. A fully unconditional model revealed sufficient Level 1 and 2 variability for young adults' affective reports, with 43% of the variability in responses being between people (τ_{00} = 0.96, z = 5.22, p < .001) and 57% of the variability being within people (σ^2 = 1.29, z = 24.45, p < .001).

As is depicted in the equation below, trial and bet outcome were entered as Level 1 variables and task structure was included as the Level 2 variable. Baseline happiness was included as a covariate. The model resulted in a better fit when slopes were constrained, $\chi 2$ (9) = 848.6, $p < .05$.

Level 1: Affective Response$_{ij}$ = β_{0ij} + β_{1ij} (Trial) + β_{2ij} (Bet Outcome) + β_{3ij} (Trial X Bet Outcome) + r_{ij}

Level 2: $\beta_{0i} = \gamma_{00} + \gamma_{01}$ (Baseline Happiness) + γ_{02} (Task Structure) + u_{0i}

$\beta_{1i} = \gamma_{10} + \gamma_{11}$ (Task Structure)

$\beta_{2i} = \gamma_{20} + \gamma_{21}$ (Task Structure)

$\beta_{3i} = \gamma_{30} + \gamma_{31}$ (Task Structure)

The fixed and random effects are presented in Table 3. The significant interactions between trial and task structure, γ_{11} = -0.05, t = -2.78, p = .005, and bet outcome and task structure, γ_{21} =- 0.02, t = -2.05 p = .04, were qualified by a three-way interaction between bet outcome, trial, and task structure, γ_{31} = 0.06, t = 2.64, p = .008. This model accounted for 8% of the between-person variance and 11% of the within-person variance.

Table 3
Estimates for Multilevel Model Examining Young Adults' Affective Responses

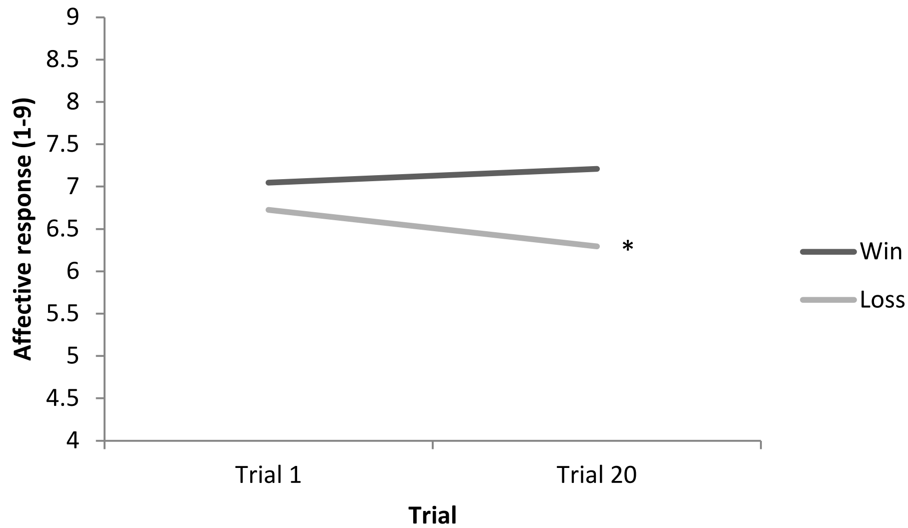
Fixed effects	
Intercept	6.10 (.22)**
Trial	0.02 (.01)
Bet outcome	1.18 (.18)**
Task structure	0.62 (.30)*
Trial x bet outcome	-0.03 (.02)
Trial x task structure	-0.05 (.02)**
Bet outcome x task structure	-0.86 (.24)**
Bet outcome x trial x task structure	0.06 (.02)**
Random effects	
Intercept	0.88 (.17)**
Residual	1.15 (.05)**

Note: *$p < .05$; ** $p < .01$

Two additional models were conducted to interpret the three-way interaction by examining the effects of trial and bet outcome between task structures. The relationships between bet outcome and trial in each of the task structures are depicted in Figure 2. Overall, the intensity of younger adults' responses to gain trials was stronger than their responses to loss trials, though they reported stable responses to gains in both task structures. Responses to the experience of losses did differ across task structures. In the risky task structure, young adults became less affected by losses over time whereas in the non-risky task structure, young adults displayed increases in negative responses to losses over time. Simple slopes analyses were conducted within each task structure as a follow-up test. The slopes for reactions to losses were significantly different from zero in the risky (t = -1.99, p = .04) and non-risky task structures (t = 2.05, p= .04) whereas, the slopes for gains were not significantly different than zero (p > .40). These findings are consistent with the hypothesis that young adults would display stronger responses to achieving wins than to avoiding losses.

The differential responses to losses over trials across task structures was not expected, but may reflect degree of frustration associated with payoff structures based on consistency with presumed regulatory focus.

(a)



(b)

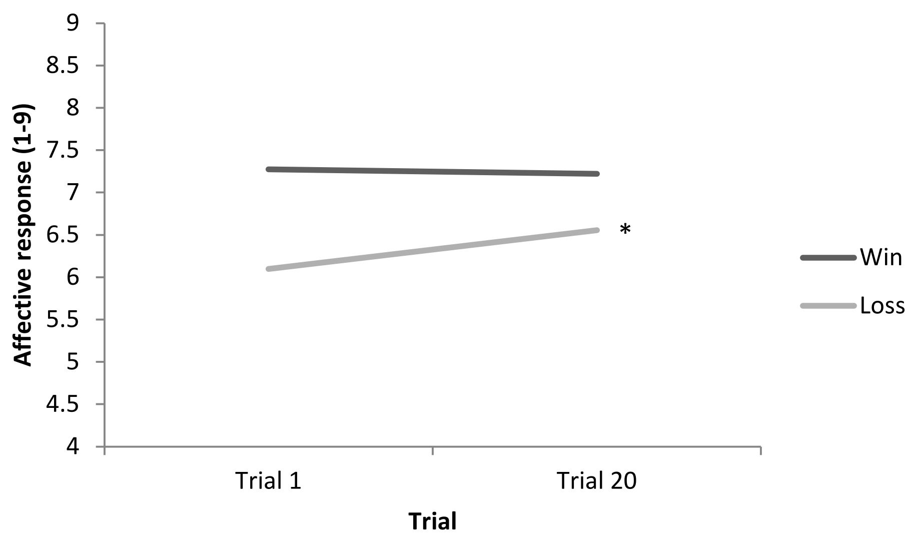


Figure 2. Young adults' responses to wins and losses across trials in the (a) risky task structure and the (b) non-risky task structure.
Note: * indicates slope is significantly different from 0 (p < .05).

Older adults. The results of a fully unconditional model revealed that 37% of the variance in older adults' affective responses was between people (τ_{00} = 0.74, z = 5.08, p < .001) and 63% of the variance was within people (σ^2 = 1.27, z = 24.25, p < .001).

A similar model was conducted as the previous analysis, with trial and bet outcome entered as the Level 1 variables and task structure included as the Level 2 variable. Baseline happiness was entered as a covariate. The model resulted in a better fit when slopes were constrained, $\chi 2$ (9) = 477.3, p < .05.

This model yielded significant main effects of trial, γ_{10} = 0.03, t = 2.18, p = .03, and bet outcome, γ_{20} = 0.89, t = 5.13, p < .001. Given the lack of effects for task structure, the model was rerun without the Level 2 variable in order to test for continued significance for the main effects.

Level 1: Affective Response$_{ij}$ = β_{0ij} + β_{1ij} (Trial) + β_{2ij} (Bet Outcome) + β_{3ij} (Trial X Bet Outcome) + r_{ij}

Level 2: $\beta_{0i} = \gamma_{00} + \gamma_{01}$ (Baseline Happiness) + u_{0i}

$\beta_{1i} = \gamma_{10}$

$\beta_{2i} = \gamma_{20}$

$\beta_{3i} = \gamma_{30}$

As can be seen in Table 4, the previously established main effects remained significant after removing task structure from the model. The interaction between bet outcome and trial was marginally significant, γ_{30} = -0.02, t = -1.80, p = .07. Simple slopes analyses were conducted to identify whether the source of the marginal interaction was in fact due to older adults' response to losses, as appears to be the case in Figure 3. The slope for losses was significantly different from zero (t = 3.65, p < .001), however the slope for gains was not (t = 1.26, p = .21). Similar to young adults, older adults were happier after experiencing gains than they were unhappy after experiencing losses. Although the interaction between trial and bet outcome was not significant, the trend in the data depicts stable responses to gains over time and increases in the intensity of responses to losses over time. For older adults, the slope for losses is consistent with the hypothesis that motivation to avoid incurring losses would result in a strong emotional response to the experience of accrued losses. This model accounted for 12% of the within person variance.

Table 4
Estimates for Multilevel Model Examining Older Adults' Affective Responses

Fixed effects	
Intercept	6.27 (.14)**
Trial	0.03 (.01)**
Bet outcome	0.94 (.12)**
Trial x bet outcome	-0.02 (.01)
Random effects	
Intercept	0.77 (.15)**
Residual	1.12 (.05)**

Note: *p < .05; ** p <.01

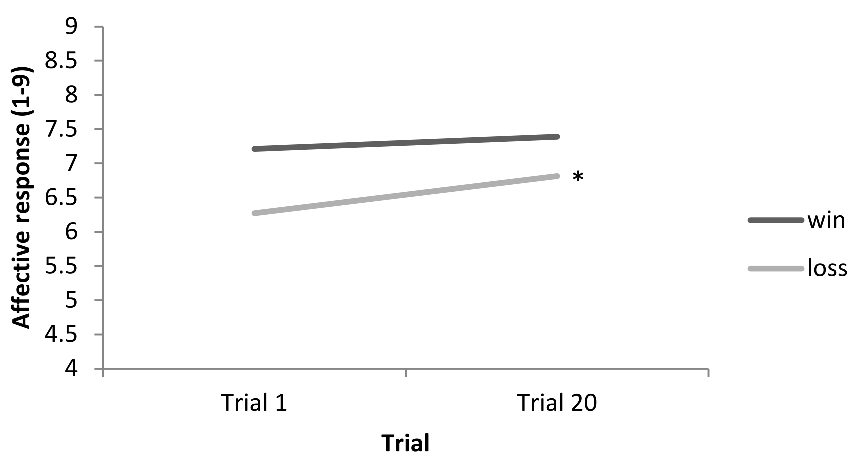


Figure 3. Older adults' affective responses to wins and losses across trials.
Note: * indicates slope is significantly different from 0 (p < .05).

In sum, both young and older adults reported stronger affective responses to trials resulting in wins than to those resulting in losses. Contrary to predictions, task structure only influenced young adults' affective responses, with increases in negative affect over time in the non-risky task structure and decreases in negative affect over time in the risky task structure. It is possible that young adults expected to experience more losses in the less predictable risky task structure and thus were less emotionally impacted by the occurrence of a loss. The more predictable nature of the non-risky task structure may have made the occurrence of a loss seem more avoidable which, in turn, may have lead to a stronger affective response. Consistent with hypotheses, there was a trend for older adults being more strongly sensitive to the accrued experience of losses over trials.

Final affective response. At the conclusion of the game, after receiving the amount of money they won, participants were asked to provide a final affective rating ("How happy do you feel right now?") on a 9-point scale. A linear regression was conducted to examine the influence of age group, task structure, and total winnings (i.e., total amount of money won in the game) on end-game happiness. Baseline happiness was entered as a covariate. As depicted in Table 5, total winnings was the only significant predictor of end-game happiness (p = .04). Not surprisingly, participants who won more money reported being happier at the end of the game.

Table 5
Predictors of final affective response

	B	SE	β
Age Group	0.42	0.94	0.12
Task Structure	0.50	0.43	0.14
Total winnings	0.35	0.17	0.77*
Task structure X winnings	-0.09	0.11	-0.32
Task structure X age	-0.15	0.60	-0.07
Age X winnings	0.16	0.25	0.24
Task structure X winnings X age	-0.17	0.15	-0.43

Note. R^2 = 0.29; *p < .05

Affective Forecasts

Game forecasts. Before considering the accuracy of affective forecasts, group differences in participants' predictions of how happy they would feel after winning or losing were examined. First, it was established that both young and older adults reported similar baseline happiness levels (M = 7.56, SD = 1.42), F (1, 125) = 0.95, p = .33, η_p^2 = .01. A 2 (Age Group) X 2 (Anticipated Outcome [win vs. lose]) repeated measures analysis of covariance (ANCOVA) was then conducted on affective forecasts, with baseline happiness entered as a covariate. As would be expected, participants predicted that they would be less happy after losing the game (M = 3.29, SD = 1.56) than after winning the game (M = 8.27, SD = 0.93), F (1, 123) = 39.27, p <.001, η_p^2 = .24. Note also that the intensity of response was stronger for winning than for losing (in terms of the deviation from the midpoint of 5). The Age Group X Outcome interaction was not significant, F (1, 123) = 0.07, p = .80, η_p^2 = .00, indicating that young and older adults anticipated similar affective responses to both winning and losing.

Bet forecasts. In addition to predicting how they would feel after playing the game, participants were also asked to predict how happy they would feel after winning or losing a bet. A similar 2 (Age Group) X 2 (Anticipated Outcome [win vs. lose]) repeated measures ANCOVA was conducted on participants' predicted happiness after winning and losing a bet. Baseline happiness was included as a covariate. Consistent with the previous analysis, participants predicted that they would be happier after winning a bet (M = 7.96, SD = 0.97) than after losing a bet (M = 3.62, SD = 1.59), F (1, 123) = 30.41, p <.001, $\eta_p^2 = .20$. The Age Group X Outcome interaction was not significant, F (1, 123) = 1.58, p = .21, $\eta_p^2 = .01$, indicating no age differences in predicted responses to wins and losses.

Affective Forecasting Accuracy

The main focus of the study was on the accuracy of participants' affective forecasting, which was assessed in two ways. First, regression analyses were conducted to examine the accuracy of participants' predicted affective states at the end of the gambling task based on how much they won or lost. The second analysis focused on the accuracy of participants' predicted affective state after experiencing a bet which resulted in either a gain or a loss.

Overall outcome. Two discrepancy scores were computed by subtracting experienced happiness from forecasted happiness after losing and after winning the game. Two separate linear regression models were then conducted: one for the discrepancy of loss forecasts and the other for the discrepancy of win forecasts. Age group, task structure, and the amount of money won (continuous variable) were entered into the model along with their interactions (Table 6). Baseline happiness was entered as a covariate. Both baseline happiness and amount of money won were grand mean centered. In general, it would be expected that discrepancy scores involving predictions of happiness following losing would decrease as losses in the game increased. In contrast, discrepancy scores involving predicted happiness following wins should decrease as winnings increase. Of interest is whether the degree of discrepancy is related to age or task structure.

Table 6
Predictors of Loss Accuracy

	B	SE	β
Age Group	.53	1.31	.11
Task Structure	.43	0.60	.09
Total winnings	-.10	0.24	-.13
Task structure X winnings	-.11	0.15	-.32
Task structure X age	-.46	0.84	-.16
Age X winnings	-.54	0.35	-.63
Task structure X winnings X age	.44	0.21	.86*

Note. R^2 = 0.17; *p < .05

When discrepancy scores for loss forecasts were examined, the only significant effect obtained was an Age Group X Task Structure X Amount Won interaction, β = .86, *p* = .04. A depiction of this interaction can be seen in Figure 4, where discrepancy scores were estimated at 1 standard deviation above and below the sample mean of amount won. Overall, participants were generally more accurate when experienced outcome corresponded with their anticipated outcome. That is, the discrepancy between post-game happiness and anticipated happiness after losing was smaller when participants lost the game (i.e. received less money) than when they won. This pattern is generally more true for older adults than for the young, which suggests that they are more accurate in predicting their responses to loss. These results also suggest that young adults tend to over predict how they will feel, which is consistent with previous studies of affective forecasting. Additionally, task structure differentially influenced the accuracy of older adults' forecasts. The relationships between age group, task structure, and amount won are depicted in Figure 4. It should be noted that since these analyses examine forecast accuracy in the loss domain, the focus of these results is on the bars depicting discrepancy for low winnings. As can be seen in the figure, older adul ts' forecasts were more accurate under the non-risky task structure. That is, older adults more accurately predicted how they would feel if they lost when the loss was experienced in the non-risky program. Older adults felt worse than they anticipated when the loss was experienced in the risky task structure, perhaps suggesting that prevention relevant responses were amplified under less predictable conditions.

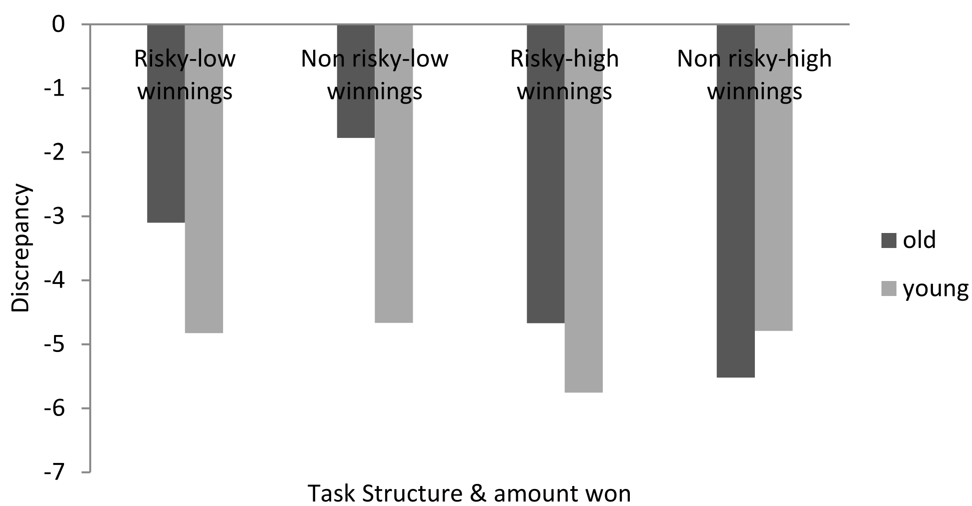


Figure 4. Estimated age differences in loss discrepancy scores by amount won in both task structures.

When the discrepancy between experienced affect and anticipated affect following winning was examined, no significant effects emerged. There was a trend in the data, however, suggesting that increases in total money won were associated with a smaller discrepancy, $\beta = -.69$, $p = .07$. In other words, participants' post-game happiness was closer to their anticipated happiness following winning if they actually won (Figure 5). Note again that the focus of this analysis is on the data depicting high winnings.When winnings were higher, both young and older adults only slightly over-predicted their affective responses. When winnings were lower, participants in both age groups greatly over-predicted their responses, which should be expected since they were essentially losing the game.

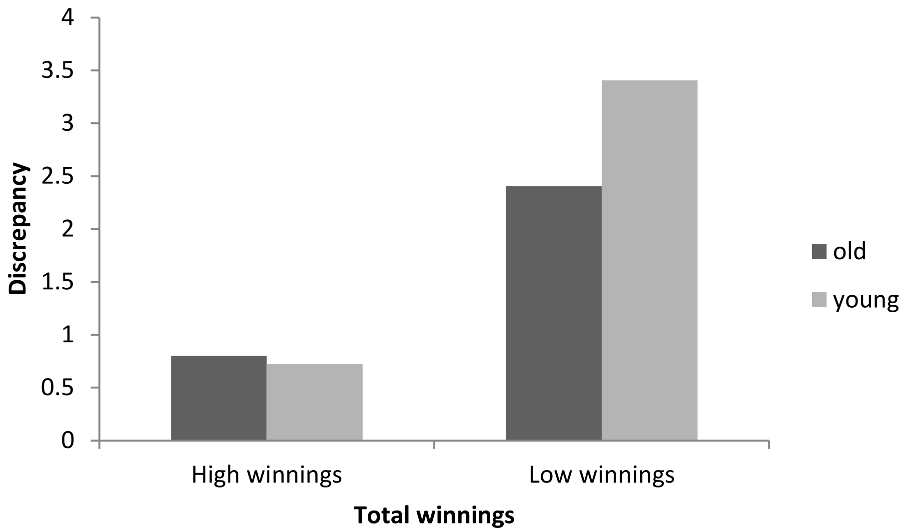


Figure 5. Estimated age differences in gain discrepancy scores by amount won.

Trial-by-trial discrepancy outcomes. In the next set of analyses, I used multi-level modeling to examine discrepancy scores following each trial as opposed to scores based on a summary affect measure following task completion. Because trials resulting in both wins and losses were included in the model, affective responses to loss trials were reverse coded to create consistency in the scale and to facilitate interpretability. Discrepancy scores were calculated by subtracting participants' reported experienced affect for each trial from their forecasted affect following the experience of a bet resulting in a gain or a loss. Thus, lower scores represent under-estimation of response intensity, whereas higher scores represent overestimation of intensity. In order to test for a linear effect of time, trial number was entered as a Level 1 variable along with bet outcome. Age group and task structure were entered as Level 2 variables and baseline happiness was included as a covariate.

A fully unconditional model determined that 33% of the variance was between people (τ_{00} = 0.62, *z* = 7.15, *p* < .001) and 67% of the variability was within people (σ^2 = 1.25, *z* = 34.46, *p* < .001). The following model resulted in a better fit when the slopes between trial and affective response and bet outcome and affective response were constrained, $\chi 2$ (9) = 1203.5, p < .05:

Level 1: $\text{Discrepancy}_{ij} = \beta_{0ij} + \beta_{1ij}$ (Trial) $+ \beta_{2ij}$ (Bet Outcome) $+ \beta_{3ij}$ (Trial X Bet Outcome) $+ r_{ij}$

Level 2: $\beta_{0i} = \gamma_{00} + \gamma_{01}$ (Baseline Happiness) $+ \gamma_{02}$ (Age Group) $+ \gamma_{03}$ (Task Structure) $+ \gamma_{04}$ (Age Group X Task Structure) $+ u_{0i}$

$\beta_{1i} = \gamma_{10} + \gamma_{11}$ (Age Group) $+ \gamma_{12}$ (Task Structure) $+ \gamma_{13}$ (Age Group X Task Structure)

$\beta_{2i} = \gamma_{20} + \gamma_{21}$ (Age Group) $+ \gamma_{22}$ (Task Structure) $+ \gamma_{23}$ (Age Group X Task Structure)

$\beta_{3i} = \gamma_{30} + \gamma_{31}$ (Age Group) $+ \gamma_{32}$ (Task Structure) $+ \gamma_{33}$ (Age Group X Task Structure)

As can be seen in Table 7, this model revealed a significant three-way interactions between trial, bet outcome, and task structure, γ_{32} = -0.05, *t* = -2.92, *p* = .003, and trial, task structure, and age group, γ_{13} = -0.05, *t* = -2.20, *p* = .03.

Table 7
Estimates for Multilevel Models Examining Discrepancy Scores

Fixed effects	
Intercept	0.23 (.20)
Trial	-0.02 (.01)
Bet outcome	0.47 (.17)**
Age group	-0.10 (.28)
Task structure	-0.26 (.26)
Trial x bet outcome	0.03 (.02)
Trial x age group	-0.002 (.02)
Trial x task structure	0.04 (.02)**
Bet outcome x age group	0.13 (.24)
Bet outcome x task structure	0.47 (.23)*
Trial x bet outcome x age group	-0.0003 (.02)
Trial x age group x task structure	-0.05 (.02)*
Bet outcome x trial x task structure	-0.05 (.02)*
Bet outcome x age group x task structure	-0.14 (.33)
Trial x bet outcome x age group x task structure	0.04 (.03)
Random effects	
Intercept	0.61 (.08)**
Residual	1.08 (.03)**

Note: *p < .05; ** p <.01

Given the interest in age differences in accuracy of affective forecasts, two separate models were conducted in order to facilitate interpretation of the interactions and to examine patterns of discrepancy within age groups.

Young adults. A fully unconditional model revealed sufficient Level 1 and 2 variability for young adults' discrepancy scores, with 41% of the variability in responses being between people (τ_{00} = 0.68, z = 5.20, p < .001) and 59% of the variability being within people (σ^2 = 0.96, z = 24.46, p < .001).

Trial and bet outcome were entered as Level 1 variables and task structure was included as the Level 2 variable. The model resulted in a better fit when slopes were constrained, $\chi 2$ (9) = 542.8, p < .05.

Level 1: $\text{Discrepancy}_{ij} = \beta_{0ij} + \beta_{1ij}$ (Trial) + β_{2ij} (Bet Outcome) + β_{3ij} (Trial X Bet Outcome) + r_{ij}

Level 2: $\beta_{0i} = \gamma_{00} + \gamma_{01}$ (Baseline Happiness) + γ_{02} (Task Structure) + u_{0i}

$\beta_{1i} = \gamma_{10} + \gamma_{11}$ (Task Structure)

$\beta_{2i} = \gamma_{20} + \gamma_{21}$ (Task Structure)

$\beta_{3i} = \gamma_{30} + \gamma_{31}$ (Task Structure)

The fixed and random effects for this model are presented in Table 8. The significant interactions between trial and task structure, $\gamma_{11} = 0.05$, $t = 3.22$, $p = .001$, and bet outcome and task structure, $\gamma_{21} = 0.47$, $t = 2.29$, $p =.02$, were qualified by a three-way interaction between bet outcome, trial, and task structure, $\gamma_{31} = -0.05$, $t = -2.86$, $p = .004$. This model accounted 9% of the within person variance.

Table 8
Estimates for Multilevel Model Examining Young Adults' Discrepancy Scores

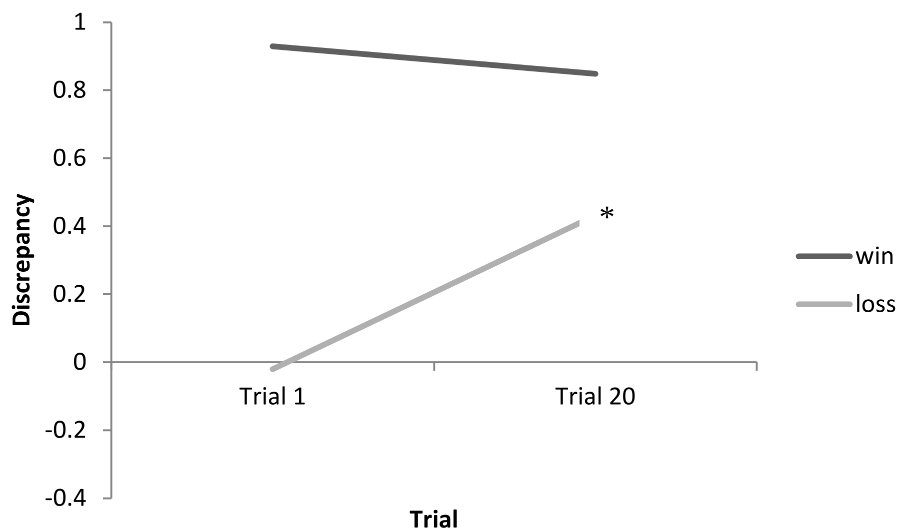
Fixed effects	
Intercept	0.24 (.20)
Trial	-0.02 (.01)*
Bet outcome	0.47 (.15)**
Task structure	-0.26 (.27)
Trial x bet outcome	0.03 (.01)
Trial x task structure	0.04 (.01)**
Bet outcome x task structure	0.47 (.21)*
Bet outcome x trial x task structure	-0.05 (.02)**
Random effects	
Intercept	0.75 (.20)**
Residual	0.84 (.03)**

Note: *$p < .05$; ** $p <.01$

Two additional models were conducted in order to interpret the significant three-way interaction. The effects of trial and bet outcome were examined between the risky and non-risky task structures, which can be seen in Figure 6.

In both task structures, young adults consistently over-predict their affective responses to winning, which is consistent with previous findings in the affective forecasting literature. A simple slope analyses revealed that this slope was not significantly different than zero (t = -0.48, p = .62). There are differences in task structures, however, when focusing on the discrepancy between predicted and experienced responses to trials resulting in a loss. Simple slopes analyses revealed that the slopes for loss discrepancy were significantly different from zero in both the risky (t = 2.67, p = .01) and non-risky task structures (t = 2.01, p = .04). In the risky task structure, young adults are quite accurate in their predictions in the beginning trials. As losses accumulate, however, discrepancy increases and results in over prediction of affective response. The opposite pattern is observed in the non-risky task structure. Young adults began by over predicting their responses to loss, but their forecasts became more accurate after the experience of repeated losses.

(a)



(b)

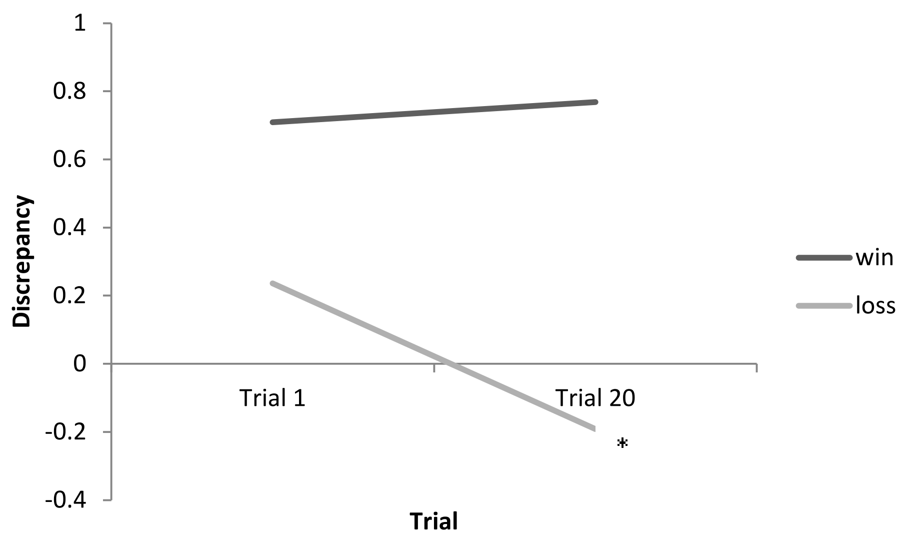


Figure 6. Effects of trial and bet outcome on young adults' forecasting accuracy in the (a) risky task structure and the (b) non-risky task structure.
Note: * indicates slope is significantly different from 0 ($p < .05$).

Older adults. In order to examine older adults' forecasting accuracy across trials, the same model used for young adults was conducted. Trial and bet outcome were included as the Level 1 variables and task structure was added as a Level 2 variable. Baseline happiness was included as a covariate. A fully unconditional model revealed sufficient variability in discrepancy scores with 25% of the variance being between people (τ_{00} = 0.51, z = 4.80, p < .001) and 75% of the variance being within people (σ^2 = 1.54, z = 24.27, p < .001). The model resulted in a better fit when slopes were constrained, $\chi 2$ (9) = 651.6, p < .05.

This model produced a main effect of bet outcome, γ_{20} = 0.60, t= 3.21, p = .001, and a marginal effect of trial, γ_{10} = -.02, t= -1.94, p = .05.

A second model was conducted to see if the effect of bet outcome remained significant once trial structure was removed from the model. The fixed and random effects for this model are reported in Table 9. The effect of bet outcome did remain significant and the main effect of trial became significant. A significant two-way interaction did not emerge, but visual inspection of Figure 7 suggests that change in accuracy was much greater for losses than for gains. A simple slopes analysis determined that the slope for discrepancy for wins was not significantly different from zero (t = -0.94, p = .35); thus, there was a trend for older adults to overpredict their responses to wins over trials. The discrepancy between predicted and experienced responses to loss trials resulted in a much different pattern. The simple slope for losses was significantly different from zero (t = -3.03, p = .002), which suggests a trend for older adults being quite accurate in their predictions of their responses to losses at the beginning of the task, but underestimating how they felt after the experience of losses by the end of the trials. This model accounted for 14% of the within person variance.

Table 9
Estimates for Multilevel Model Examining Older Adults' Discrepancy Scores

Fixed effects	
Intercept	-0.09 (.13)
Trial	-0.03 (.01)**
Bet outcome	0.78 (.13)**
Trial x bet outcome	0.02 (.01)
Random effects	
Intercept	0.50 (.10)**
Residual	1.32 (.05)**

Note: **p* < .05; ** *p* <.01

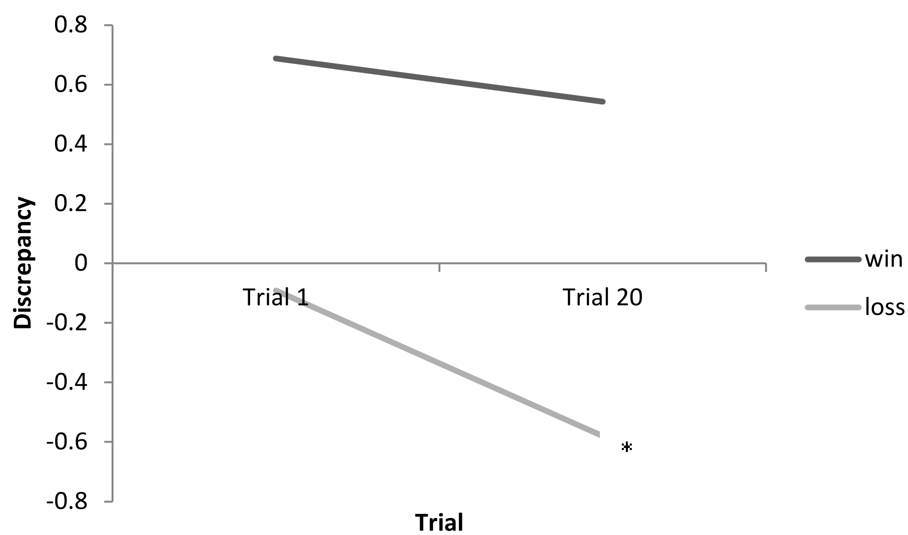


Figure 7. Effects of trial and bet outcome on older adults' forecasting accuracy.
Note: * indicates slope is significantly different from 0 ($p < .05$).

In sum, consistent with previous affective forecasting research, both young and older adults over predicted their responses to experiencing a win, at least at the beginning of the task. Both age groups also maintained a large discrepancy between anticipated and experienced responses over trials.

Young and older adults' discrepancy scores for losses followed different patterns. Similar to the previous analyses of affective responses, task structure only influenced the accuracy of young adults' forecasts in the loss domain. In the risky task structure, young adults' predictions were quite accurate at the beginning of the task but became less accurate over trials as a result of over predicting their negative responses. Those in the non-risky task structure over predicted their responses in the beginning trials of the task, but became more accurate over time. Although the interaction was not significant, older adults, similar to young adults in the risky task structure, were more accurate in their predicted responses to losses in the beginning trials of the task; however, as losses accrued, older adults under-predicted the magnitude of their affective response. That is, there was a trend suggesting that by the end of the task, older adults felt worse in response to losses than they had anticipated.

Queries and Regulatory Focus

In the final set of analyses, I examined the degree to which age and regulatory focus were related to the type of queries produced in response to the probe questions. Two coders were trained to classify the focus of participants' thought listings. Each thought was coded as gain-related (e.g., "I feel like I'm going to win") or loss-related (e.g., "I'm not a lucky gambler and will likely lose"). Out of 276 thoughts, 182 could not be categorized as gain or loss-related and were therefore eliminated. Eliminated thoughts were either off topic (e.g. "This room is warm") or not specifically related to the outcome of the gambling game (e.g. "I never gamble"). The interclass correlations between the two coders for each of the possible five thoughts ranged from 87% to 100% (*ps* < .001). Since we were interested in the proportion of gain and loss-related thoughts, a third judge examined the previous coders' discrepancies and recoded those thoughts. The participants' age groups were blind to all three coders.

Unfortunately, only 85 participants (50 young adults, 35 older adults) out of the total sample provided at least one relevant gain or loss-related thought. Ratios of gain and loss-related thoughts were computed in order to examine their relationship with age group and regulatory focus. Consistent with predictions, the promotion focus subscale was positively correlated with proportion of gain-related thoughts, r (83) = .25, p = .02, and negatively correlated with proportion of loss-related thoughts, r (83) = -.25, p = .02. Contrary to hypotheses, however, age was not significantly related to proportion of gain-related thoughts, r (83) = -.06, p = .59, or proportion of loss related thoughts, r (83) = .06, p = .59.

Order of queries was also examined. Query theory predicts that queries are executed in a sequence related to individuals' goals or task structure. For this specific task, it was hypothesized that age differences in regulatory focus would determine the order of gain versus loss-related thoughts. A chi-square analysis was conducted and revealed that there were age differences in the focus of participants' first thought, χ^2 (1, N = 85) = 4.40, p = .04, with young adults producing more gain-related first thoughts (66.7%) than older adults (33.3%) and older adults producing more loss-related first thoughts (57.1%) than young adults (42.9%). These results suggest that goal orientation was related to information participants considered before they engaged in the gambling game. In order to examine this further, a series of logistic regression models were conducted. Age was entered into the first model and was a significant predictor of first thought, β = -.98, OR =0.38, p = .04, with younger adulthood being associated with more gain-related first thoughts. When the promotion focus subscale was entered into the model, age was no longer a significant predictor (p = .71). Higher scores on the promotion focus subscale were associated with more gain-related thoughts, β =.39, OR =1.48, p = .01. Consistent with query theory, thoughts participants produced first were strongly related to their goal orientation. The interaction between age group and promotion focus was entered in the last block of the model and resulted in no significant effects.

In an attempt to connect participants' queries to their affective forecasts, 2 (Age Group) X 2 (First Query [gain vs. loss]) univariate ANOVAs were conducted on forecasts for winning and losing the gambling game. Although there were no significant effects for loss forecasts, there was a trend for forecasts of winning with participants whose first thoughts were gain-related predicting that they would be happier after winning the game (M = 8.50, SD = 0.74) than those who provided loss-related first thoughts (M = 8.11, SD = 1.10), F (1, 82) = 3.77, p = .056, η_p^2 = .04. A similar effect emerged in examining participants' predicted responses to winning a bet, with gain-related first thoughts leading to more positive predicted affective response (M = 8.30, SD = 0.81) than loss-related first thoughts (M = 7.68, SD = 1.12), F (1, 82) = 8.55 p = .004, η_p^2 = .09.

It should be noted that these analyses were based on a rather small subgroup of the overall sample. Although there seem to be interesting trends in the data, the effects should be taken with caution due to the relatively small sample. The small available sample size and associated loss in statistical power also precluded further analyses examining the relationship between queries and affective forecasts.

Discussion

The goal of the present study was to understand the role of regulatory focus in determining adult age differences in the accuracy and construction of affective forecasts. By engaging participants in a computer-based gambling game, I was able to compare young and older adults' responses to wins and losses over time, their anticipated affective states, and the accuracy of their predictions. I was additionally able to compare the focus of young and older adults' thoughts regarding the outcome of the game by using a query theory procedure.

After establishing that young adults were more strongly promotion focused than young adults, I began testing the hypothesis that young and older adults would report different emotional responses to gains and losses. More specifically, I predicted that maintaining a promotion focus would lead to stronger emotional response to achieving wins and that maintaining a prevention focus would be associated with stronger affective responses to losses. It was also thought that the accuracy of participants' affective states would vary as an influence of goal orientation and task structure, with accuracy occurring where regulatory fit was present. Increased inaccuracy was expected when there was a match between task structure and age-relevant regulatory focus goals. That is, young adults were hypothesized to overestimate their responses in the risky task structure, especially when the outcome was gain-related whereas older adults were expected to overestimate their affect states in the non-risky task structure, especially for outcomes resulting in loss. The last hypothesis tested in this study was that age and goal orientation would be related to a) the proportion of gain and loss queries and b) the order in which these queries were elicited.

Young and Older Adults' Affective Responses

One notable contribution of this study was the ability to examine young and older adults' affective reactions to the experience of gains and losses over time. These data were analyzed by conducting multilevel models for young and older adults in order to compare responses across the two age groups. Although results were not completely consistent with hypotheses, the findings do suggest young and older adults display distinct patterns of responses to gains and losses.

In regards to responses to gains over trials, young adults in both task structures reported more intense reactions to gains than losses, as predicted. Interestingly, these reactions remained stable throughout the task, which implies that the accumulation of gains did not influence their affective responses. These findings are somewhat consistent with the hypothesis that young adults' orientation toward achieving gains would result in a stronger response to the achievement of this goal, though it is uncertain as to why the accrued experience of gains was not associated with increases in positive affect. Their overall responses to gains were high, however, leaving less room for increases in responses over time.

Contrary to gain trials, task structure was influential in young adults' responses to losses over trials. The experience of losses in the risky task structure did not result in increases in negative affect over time. Instead, young adults in this task structure reported less intense negative affect over trials. Although this explanation was not able to be tested, it is possible that young adults realized this task structure resulted in unpredictable outcomes, which buffered the experience of intense negative reactions in response to accrued losses. These responses may be contrasted with those of young participants in the non-risky task structure. In this condition, participants reported increases in negative affect as a result of incurring losses over time. Compared to the risky task structure, the non-risky condition provided a more predictable win/loss ratio. Again, this explanation cannot be confirmed with the current data, but it is possible that in this condition, losses lead to increased frustration given the probabilistic nature of the task. If young adults felt that the outcome did not follow the probabilistic structure, they may have responded more negatively to repeated losses over time.

Older adults displayed a similar pattern of reactions as young adults to gains over time, in that their reports of positive affect in response to the experience of gains remained stable over the course of game trials. In comparing older adults' reactions to gains versus losses, the pattern is again somewhat similar to young adults. Although older adults reported more intense positive reactions to winning than negative reactions to losing, they also tended to exhibit greater sensitivity to losses over trials. It seems that regardless of age—and presumably goal orientation—participants were more affectively responsive to winning bets than they were to losing.

Unlike young adults, task structure did not influence older adults' affective responses to losses. Their pattern of loss responses was quite similar to that of young adults in the non-risky task structure, with increases in the intensity of negative affect increasing over trials. This pattern was somewhat expected, given the prevention focused goal of avoiding losses, although I did expect intensity to be stronger in the risky condition. In general, the experience of repeated losses conflicted with the presumed goal of avoiding negative outcomes, which tended to increase the intensity of negative responses.

It is interesting that the risky task structure did not amplify older adults' reaction to losses, and that task structure as a whole only influenced young adults' responses. One suggestion may be that older adults were not sensitive to the different task structures; however, analyses of bet riskiness indicated that both young and older adults responded to the payoff structures of the task, as evidenced by their switching from safe to risky bets in the risky task structure. Alternatively, it may be possible that task structure was less impactful to older adults due to their approach to the game. In a previous study examining age differences in performance on the Iowa Gambling Task, researchers determined that young and older adults attended to different information in the gambling game (Wood et al, 2005). Although the game outcome was similar for both age groups, older adults displayed a higher rate of forgetting of game trials and a stronger recency effect, meaning they put more weight on the outcome of the immediate past trial in making their next bet. Young adults were more likely integrate the outcomes of the past several trials in guiding their future bets. In the current study, older adults' may have been more likely than younger adults to engage in a less systematic, less mindful response to the task, leading to less integration of the outcomes of previous bets and ultimately less sensitivity to the payoff structure. Previous research has established similar age differences in information-seeking behavior. In a study examining age differences in information acquisition, Hess, Pullen, and McGee (1996) found that young adults engaged in a rule-based, hypothesis-testing strategy, which was beneficial to performance when the task required active integration of information over trials. Older adults, on the other hand, relied on more intuitive processing, which lead to poorer performance under such task conditions.

An additional explanation for the lack of task structure effects is that older adults were not concerned with the different payoff schemes and that it was the experience of a loss, regardless if it was predictable or not, that most influenced affective responses. This explanation is parallel to the findings of Nielsen, Knutson, and Carstensen (2008), who reported that older adults displayed increased negative affect in response to the experience of losses, regardless of whether the loss was anticipated or not. Although their sample engaged in a slightly different task, the idea of anticipating an outcome may apply to the effects found in the current study.

Affective Forecasting and Age Differences in Accuracy

Both young and older adults provided similar affective forecasts, with participants reporting that they would feel happier after winning than after losing. This pattern of responses was true for predictions at the game and bet levels, and is consistent with findings obtained by Löckenhoff, O'Donoghue, and Dunning (2011) who observed no age differences in anticipated affect in a temporal discounting task.

Age differences did emerge in the present study when affective forecasting accuracy for game outcome was examined. In focusing on participants' forecasts of game outcome, young adults tended to overestimate how unhappy they would feel after losing the gambling game. Older adults, especially those in the risky task structure, were more accurate in their forecasts for losing. Additionally, both age groups only slightly overestimated their responses to winning. These findings did not necessarily mirror the hypothesized influence of regulatory focus. It was originally proposed that young adults would overestimate their reaction to winning, especially in the risky task structure and that older adults would overestimate their reaction to losing, particularly in the non-risky task structure. The results of these analyses suggest, however, that older adults are overall more accurate in their forecasts than young adults in the domain of losses and that both age groups are inaccurate in their predictions of gains. These effects are not dissimilar to those established by Nielsen and colleagues (2008), who found that compared to young adults, older adults provided more accurate forecasts in response to losses. It is important to note that their results were obtained only for forecasts of arousal, not valence, using a much different gambling task. As proposed by Nielsen and colleagues, it is possible that older adults have better insight into their affective responses and are better able to predict their responses, regardless of their goal orientation.

In addition to considering overall forecast accuracy, I also examined how accuracy was sustained over task trials. Similar to the results related to affective responses, task structure was most influential in the loss domain in the younger age group. Young adults in the risky task structure began the game with very accurate predictions of how they would feel following a loss, but over-predicted their responses as loss accrued throughout the game. An opposite effect was found for young adults in the non-risky condition. In this group, young participants started the game by over-predicting how they would feel in response to losses, but became more accurate over time. These task structure differences may come back to the predictability of the occurrence of losses in the risky versus non-risky structures. Young adults in the non-risky structure may have felt less negative than they anticipated because they felt that losses were less avoidable in this structure. Because of the more predictable pattern of outcomes in the non-risky structure, it is possible that young adults felt worse than they predicted over time because they felt the losses could have been avoided.

Although the Trial X Bet Outcome interaction was not significant for the older age group, the trend in the data suggested that older adults began the task with accurate predicted responses to losses, but under-predicted their responses to losses over time. That is, older adults tended to feel worse than they predicted they would feel as losses accumulated. This is consistent with the hypotheses that older adults would be more likely to exhibit a prevention focus, leading to them being more sensitive to losses than young adults.

In regards to gain forecasts, young adults in both task structures consistently over-predicted their responses to winning throughout the task. The over prediction of response to gains is consistent with the hypothesis that promotion focused young adults would overemphasize their reaction to winning. Interestingly, older adults also consistently overpredicted their responses to winning. This pattern is consistent with the prediction of increased sensitivity to losses in older adulthood. Overall these results provide an interesting progression of accuracy across trials, which have not been examined in previous studies.

Goal Orientation and Query Theory

One of the aims of this study was to explore the underlying mechanisms associated with the development of affective forecasts. Query theory has been used to explain a variety of behaviors related to preference construction and was thus applied in this study to examine the role of goal orientation on thoughts regarding game outcome. Consistent with my hypotheses, there was a significant relationship between regulatory focus and the content of the queries, with higher scores on the promotion focus subscale being positively associated with a higher proportion of gain-related queries and negatively related to loss-related queries. Age group was not related to query content, though this may be a function of the small and unbalanced sample. These results reflect general findings in the literature that queries are strongly related to individuals' goals. In examining the order of queries, young adults provided more gain-related queries first whereas older adults tended to produce more loss-related queries first. This effect of order is also consistent with previous findings that individuals tend to produce goal-relevant thoughts first.

Exploratory analyses on the relationship between queries and forecasts suggest an influence of thoughts on predicted affective experiences. Although sample size limitations prevented further analyses investigating the connections between the content of queries and participants' affective forecasts, these exploratory results suggest that regulatory goals influence queries which, in turn, are associated with anticipated outcomes to the task.

These findings offer an interesting extension of query theory into the realm of affective forecasting research. They also suggest an innovative procedure for exploring age differences in risk-taking situations and elsewhere. A recent study has taken a similar approach in investigating age differences in framing effects of risky medical decisions (Woodhead, Lynch, & Edelstein, 2011). Young and older adults were asked to provide qualitative accounts describing the strategy they used in response to a decision regarding the survival or mortality rates of a medical treatment. An examination of these responses revealed that older adults focused their decisions on personal experiences whereas young adults concentrated on the provided data in the treatment descriptions. This, in turn, accounted for the observed differences in susceptibility to framing effects. Although the interest of this study was not focused on participants' preference construction, the qualitative accounts suggest that older adults view real life experiences as a valuable tool in informing and guiding their decisions. Along with the present study, this research also suggests that explorations of the linkages between participants' thoughts or subjective responses and task outcomes may provide a valuable tool for understanding the bases of age differences in decision making.

Limitations and Future Directions

One limitation of this study had to do with the exploration of a query theory perspective to age differences in affective forecasting. Specifically, participants produced a relatively small number of relevant queries, limiting the sample size and thus the types of analyses that could be performed using these data. Future studies using this procedure might provide participants with more guidance for eliciting queries by engaging participants in a practice query task before the experimental procedure. An additional solution would be to follow the procedure developed by Johnson, Haubl, and Keinan (2007), in which participants engaged in a practice task and were then asked to code their own queries at the conclusion of the study. This method forces all data to be coded, eliminating missing or uncatagorizable data.

An additional limitation concerns the task structure manipulation. Effects of task structure were limited to the younger age group, raising concerns that older adults were not sensitive to the risky versus non-risky payoff structures. Although analyses of bet riskiness suggest that both young and older adults adjusted their betting behaviors in response to the task structure, the lack of effects in the older adult group raises concerns about their interpretation of the task. Perhaps the assumption that people would understand the probabilistic nature of task was faulty, given the few trials participants had to learn the task structure. Future studies might examine the role of numeracy on the effects of task structure to investigate whether a comprehensive understanding of probability determined performance under the varying payoff structures.

Conclusion

In sum, the results of this study provide partial support for the hypothesized influence of regulatory focus on affective responses and affective forecasting. Compared to young adults, older adults were more accurate overall in their forecasts of losses. Although age differences in regulatory goals may provide an appropriate framework for interpreting these results of this study, it also seems that older adults have better insight into their emotional reactions than young adults. Researchers have previously suggested that older adults may avoid making decisions because of their anticipated emotional responses to negative decision outcomes (Mather, 2006). The results of this study suggest, however, that older adults may be better at predicting their responses to outcomes and that these predictions may accurately influence and guide their decision making processes.

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APPENDIX

Appendix A

Regulatory Focus Questionnaire

Using the scale below, please write the appropriate number in the blank beside each item.

1	2	3	4	5	6	7	8	9
Not at all true of me								**Very true of me**

1. ____ In general, I am focused on preventing negative events in my life.

2. ____ I am anxious that I will fall short of my responsibilities and obligations.

3. ____ I frequently imagine how I will achieve my hopes and aspirations.

4. ____ I often think about the person I am afraid I might become in the future.

5. ____ I often think about the person I would ideally like to be in the future.

6. ____ I typically focus on the success I hope to achieve in the future.

7. ____ I often worry that I will fail to accomplish my goals.

8. ____ I often think about how I will achieve success.

9. ____ I often imagine myself experiencing bad things that I fear might happen to me.

10. ____ I frequently think about how I can prevent failures in my life.

11. ____ I am more oriented toward preventing losses than I am toward achieving gains.

12. ____ My major goal right now is to achieve my lifelong ambitions.

13. ____ My major goal right now is to avoid becoming a failure.

14. ____ I see myself as someone who is primarily striving to reach my “ideal self”—to fulfill my hopes, wishes, and aspirations.

15. ____ I see myself as someone who is primarily striving to become the self I “ought” to be to fulfill my duties, responsibilities, and obligations.

16. ____ In general, I am focused on achieving positive outcomes in my life.

17. ____ I often imagine myself experiencing good things that I hope will happen to me.

18. ____ Overall, I am more oriented toward achieving success than preventing failure.